63.00 -

-63°00'

nterbedded dark-gany siltatone and fine- to

blobs and parbonized plant fragments

coarse-grained gray sindstone. Few beds

of pebble and cobble conglomerate. Coal

common, locally crossbedding and ripple

Age: probably late Early Cretaceous or

early Late Cretaceous

# INTRODUCTION

This is a preliminary report of geologic investigations in the lower Yukon-Norton Sound region, Alaska, Stratigraphic and structural information were obtained on a boat traverse of the lower Yukon River made by J. M. Hoare, W. W. Patton, Jr., A. R. Tagg, geologists of the U. S. Geological Survey, and R. W. White, temporary field assistant, during the summer of 1960.

Information presented in this report supersedes that published in an earlier report on the geology of the Russian Mission quadrangle (Hoare and Cooprad, 1959).

Fossil identifications are by Ralph W. Imlay, David L. Jones, and Jack A. Wolfe of the U. S. Geological Survey.

### BEDDED BOCKS

Bedded rocks ranging in age from Paleozoic to late Cenosoic and intrusive rocks of Late Cretaceous or Tertiary age crop out at intervals on the north and west bank of the Yukon from north of the mapped area downstream to the vicinity of Mountain Village. For mapping purposes the bedrock strata are divided into five units. These units are primarily lithologic rather than stratigraphic because, at the present stage of investigation, it is not possible to correlate between exposures of the strata with much assurance. However, the probable age of most of the strata, based partly on fossil evidence and partly on previous experience of the writer, is indicated where known.

Unit f includes metamorphic rocks that crop out along the river in the vicinity of Marshall. The rocks consist of light- and dark-green chlorite schist, gray quartz-mica schist, dark-gray quartzite, and pebble conglomerate. Some of the quartatte is calcareous. Pebbles in the conglomerate are well-rounded and are mostly quartaite and fine-grained volcanic rocks. The relationship of the conglomerate to the schistose rocks is unknown because the contact is covered. However, the fact that the conglomerate is less metamorphosed than the schists suggests that it may be a remnant of a younger group of rocks. No volcanic rocks were noted along the river, but greenstone formed by the alteration of mafic volcanic rocks is said to crop out in the mountains east of the river (Harrington, 1918, pt. IV).

No fessils were found in these rocks and their age is unknown. They were mapped as Carboniferous by Harrington (1918, p. 23-26, pi. III) who correlated them with less metamorphosed rocks of Permian age which crop out farther up-river. The writer thinks that Harrington's basis for correlation is rather weak and pending further field work has chosen to map the metamorphic rocks as a esparate unit,

Unit e consists of light- to dark-gray and green siliceous siltstone, and fine-grained quartrite, conglomeratic quartrite (made up chiefly of pebbles of white, gray, and black chert), chert, coarsegrained calcareous sandstone, crystalline gray limestone, and voicanic

A few fragments of crinoid columnals were found in crystalline limestone about 5 miles below Russian Mission. Crincid columnals, fragments of bryozoa, brachiopods, and plants occur in a small exposure of coarse-grained sandstone and volcanic tuff or breccia on Tuckers Slough. Small brachiopods and crinoid columnals were collected from thin-bedded dark-gray limestone which crops out on Tuckers Slough.

These rocks and fossils are thought to be of Permian age because they are similar to rocks and fossils of Permian age which crop out on the Euskakwim River below the village of Anisk (Smith, 1939, p 33; Hoars and Coonrad, 1959).

# D TEMES

Unit d is made up mostly of volcanic racks but includes some sedimentary strata. The volcanic books consist of basalt, andesite, and dacite lava flows, tuffe, and breecias. Locally minor amounts of sandstone, sittstone, and limestone are injerhedded with the volcania

The dip of the strata varies from near-horisontal to vertical but al most places the dip is 30° to 60°. Locally the flows and brecking are ne massive that their attitude can not easily be determined.

At least 10,000 feet of thin-bedded gray and graen tuff, massive breccia, baselt flows, and a small amount of limestone and siltstone crop out above and below Chagamer village. Four small collections of fossils of Jurassic and Early Cretaceous age were obtained from these atrata below Chagamot. The fossile comies of belamnites (Cylindroteuthis), ammonite fragments (cf. Olcostephanus and Polyptychites), pelecypeds (huchia crassicolis or B. sublisvis), and some undontifiable organic markings. Locally the tuffs contain fragments of carbonised wood. The fossile were examined by Ralph W. Imlay and David L. Jones. Imlay reports that the belemnites are almost certainly Jurassic and the ammonites probably Jurassic but may be Larly Cretaceous triage. Jenes reports that the pelecypods are Early Cre-

Bimilar volcanic rocks crop out at intervals farther upstream, from the vicinity of Paimiut to a point about 10 miles above Grayling Creek.

Near Pikas Point chiefly thick-bedded, media to light-gray sandstone with ripple marks and erosebedding: much carbonized plant material and a few pelecypods. Sandstone medium to chares grained, interbedded with shalepebble conglomerate and siltstone, Below Pithas Point rocks mostly thin-bedded

siltstone and shaleswith a few thick sandstone

quartz pebbles.

Age: Jurassic and Cretaceous

Most of these rocks have previously been mapped and described as greenstone of Carboniferous age, andesite and dacite flows of Tertiary or late Late Cretaceous age, and basalt flows and tuffs of Quaternary or late Tertiary age (Harrington, 1918, p. 48-50, pl. III). A few poorly preserved fossil leaves were obtained from a thin layer of soft tuff about 10 miles above the mouth of Grayling Creek. The tuff is interbedded with coal and appears to be conformable with fresh-looking basalt which overlies it. The leaves were identified by Jack A. Wolfe as Metasequoia glyptostroboides Hu and Cheng, a species that occurs throughout the Cenozoic Era.

The fossil evidence is not definite because the specimens examined by Wolfe are fragmentary and poorly preserved. Also pelecypods, Buchia crassicolis, of Early Cretaceous age were found in similar volcanic rocks 40 to 50 miles farther up the Yukon by Patton and Bickel (W. W. Patton, Jr., oral communication, 1960). Although there is a possibility that some of the volcanic rocks are of Canazoic age, present information indicates that they are probably of Mesosoic

Unit c includes sedimentary rocks of Jurassic and Cretaceous age which consist of medium- to dark-gray sandstone, greenish-gray sandstone, conglomerate, and siltstone. Some of the rocks are tuffaccous. Much of the sandstone is moderately calcareous; the siltstone is rarely calcareous

Locally the beds are graywacke-type sandstone consisting of mixtures of angular and partly rounded fragments which range in size from siltsized particles to small pebbles. However much of the sandstone appears to be fairly well sorted. It commonly contains much carbonized plant . trash and locally shows faint ripple marks and other evidence of nearshore, shallow water deposition. All of the rocks are well-indurated. Massive beds of both fine- and coarse-grained rocks commonly show spheroidal weathering.

Most of the large cutbank exposures are chiefly sandstone and conglomerate in beds I to 6 feet thick with intercalated siltstone in somewhat thinner beds. Locally massive beds of sandstone and cobble conglomerate 20 to 30 feet thick crop out. At a few places, there are large exposures made up chiefly of siltstone and shale. It is probable that fine-grained and relatively thin-bedded rocks underlie many of the covered intervals and that fine-grained rocks are at least as abundant as sandstone and conglomerate.

Four collections of fossils which range in age from Middle Jurassic to Cretaceous were obtained from these rocks. A few specimens of a small species of pelecypod were found about 4 miles below Horse Island. The fossils were identified by David L. Jones as Cardium or isocardia with an age range of Jurassic through Cretacquis. Impressions of large deciduous leaves were obtained from massive beds of sandstone about a mile below Pilot Station. They were identified by Jack A. Wolfe as Aralia wellingtoniana of Hollich and Crednaria grewiopsoides Hollick who states they are of early that Cretaceous age. Two collections of pelecypods were obtained near the mouth of the Andreafsky River. One of the collections, made a few hundred feet below the mouth of the Andreafsky River, was studied by David L. Jones who reports that it consists of Inoceramys of probable Cretaceous age. The second collection, made on Andreassky River about 2 miles above its mouth, was studied by Ralph W. Imlay who reports that it consists of Inoceramus (cf. I, luctfer Eichwald) of Middle Jurassic age.

The moceramus of Middle Jurassic age obtained from this unit of sedimentary rocks (Unit c) appear to be about the same age as some of the fossils obtained from the sequence of volcanic rocks (Unit d) which has been described above. Fossil svidence that these two groups of rocks are partly equivalent in age is borns out by the fact that Unit c includes layers of tullaceous sandstone.

### UNIT b

Unit b consists of horizontal and near-horizontal flows of vestcular olivine basult which crop out near Russian Mission and about 12 miles above Marshall, Individual flows are 5 to 15 feet thick and marked by 2 to 3 feet of scoris pear their tops, Scattered vesicles occur throughout the flows.

The flows are thought to be of Quaternary age because they are undeformed and fresh-appearing.

# INTRUSIVE ROCKS

# UNIT ET

Intrhuive igneous nacks wlong the lower Yukon are chiefly granitic but include a few dikes and sills of mafic rocks less than 20 fact thick. The intrusive mafic rocks and two or three small bedies of granitic rocks have been omitted from the geologic map owing to their small size.

The granitic rocks are light- to dark-gray, fine- to medium-grained granitic-textured rocks that range in composition from granite to disrite. They form dikes, sills and small stocks.

The granitic rocks are intrusive into strata ranging in age from late Paleonoic to late Mesosoic; so some of them, at least, are as young as Late Cretaceous or Tertiary. The fact that granite publics are common in conglomerate of Cretaceous age suggests that some of the granite bodies may be of pre-Cretaceous age.

> Light- and dark-green chlorite schist, fine coarse-grained dark-gray quartaite and

> > Age: Quaternary

Polyptychites

fossiliferous.

pebble conglomerate, and gray quarts-mica

Ammonite fragments, cf. Olcostephanus and

Thin- to massive-bedded green and gray cherty tuff interbedded with medium- to coarse-

grained, gray and green tuffs and breccias

and a small amount of fine-grained

sedimentary rock. Section sparsely

Age: Jurassic and Early Cretaceous

Belemnites, Cylindroteuthis Buchia Crassicolis or sublaevis

# SURFICIAL DEPOSITS

The surficial deposits comprise unconsolidated deposits of silt, sand, and gravel of Quaternary age. They include Recent flood-plain alluvium and older terrace gravels and silt of Pleistocene age.

Unconsolidated deposits are most extensively developed east and south of the Yukon River. From the vicinity of Blackburn south to Paimiut they form a belt at least 20 miles wide east of the river. Below Paimiut the belt widens abruptly and merges with the Yukon-Kuskokwim delta. West and north of the Yukon the deposits are best developed near the mouths of large tributary streams, such as the Aniak, Chuilnak, and Andreafsky Rivers.

The deposits contain quantities of brown peat in layers that are commonly several feet thick. Much of the peat and most of the older silt deposits are permanently frozen. The older silt deposits of Pleistocene age mantle the lower slopes of hills and ridges and in places form near-vertical bluffs along the river that are 40 to 60 feet high. Such bluffs form the west bank of the Yukon for several miles below the mouth of Grayling Creek.

### REFERENCES

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**EXPLANATION** 

Surficial deposits

Floodplain deposits and silt

Bedded rocks

Undeformed baselt flows

d

Deformed volcanic rocks

6.0

Metamorphic rocks

Intrusive, rocke

138

Gramitic rocks

Contact, dashed where approximately located

Interred fault

Syncilne

Fossil locality

Older sedimentary and volcanic rocks

Prof. Paper 192, 100 p.

Gray mill with carbonized plants; one b-foot bed Plant fossils of coal; overlain by vesicular basalt. Metasequoia glyptostroboides Hu and Cheng-Age: possibly Cenozoic We'rente breccia

> Fairly soft gray and buff sandstone with carbonized plant material, Appears to overlie velcanic rocks. Ago: ublenown

Massive red and green volcame brescia merbedded with black baskly flows.

Light-gray and lavender rhyolite flow(?) - Massive basalt flows and volcasie bressia, some flows vesicular and amygdaloddal, some black obsidian

Gently dipping this-bedded to massive gray and lavender cherty tuff; some petrified wood. Age: Cremospys or Testiary

ntly dipotes light- and darks colored in a wild brockets, interbedded with a self- flows. Taff contains large framework Age: Cretaceous on Yertlary

Manaiyo dark-gray, porportely besulf flores, ge: probably diseases of Contacable

grit or the-grained areccia. These rother harder, finns indirated than rocks shove Paimint. Upstream from head of Tuckers Slough are massive basalt flows, fine to coarse volcanic braceis and agglomerate.

Age: probably Jurasalc or Early Cretaceous

lard, fine-grained tuff or gray cherty siltatone interbedded with fine- to medium-grained Age: probably Permian and gray-green charty rocks interbedded

Small Pelecypode Carding or Jeogardia

with light- to dark-green, fine- and medium-Age: possibly Jurassic or Cretaceous

Horizontal, highly vesicular, black basalt flows Age: Quaternary ine- to coarse-grained quartzite and conglom-

eratic quartzite, gray crystalline limestone, mafic lava flows, and tuff. Age: probably Permian

dray sandstone interbedded with gray and green siltatone; carbonized plant fragments. Age: probably Jurassic or Cretaceous hin-bedded, gray and green cherty tuff

interbedded with thick- to massive-bedded, coarse-grained tuff and breccia; a few massive basalt flows near Akahamiut; much carbonized plant material in coarsegrained tuff near Ohogamut. At least 10,000 feet of strata exposed between Ohogamut and Toklik. Age: Jurassic and Early Cretaceous

163"00"

163°00

moceramus, of . I. lucifor Kichwad

Mostly light-gray and medium-gray sandstone

interbedded with dark-gray siltatone and

gray sandstone interbedded with olive green

sandstone containing large leaf impressions, ripple marks, worm tracks, and shattered

Age: late Early or early Late Cretaceous

shale. Near Pilot Station thick beds of

Plant fossils

Aralia wellingtonians of Hollick

Credneria grewiopsoides Hollick

PRELIMINARY GEOLOGY ALONG THE LOWER YUKON RIVER, ALASKA

SCALE 1: 500 000

J. M. Hoare, 30 MILES

This map is preliminary and has not been edited or reviewed for conformity with U.S.

Geological Survey standards.

Age: possibly pre-Permian Horizontal, highly vesicular, black basait flows.

Cross Slough

162°00

162"00"

1961 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET RANGES FROM 18°00', to 20°30' EAST

161000

Very hard, fine-grained, bluish-gray, fossiliferous limestons apsociated with massive colible conglemerate and calcareous grit, and broccia containing fragments of crinoids, bryosoans, brachiopods, and Age: probably Permian